Work Plan

For

Review, Conceptual Model, Data Compilation, and Analysis of Washington Stream data under Nutrient Scientific Technical Exchange Partnership Support (N-STEPS)

Prepared for:

U.S. Environmental Protection Agency
Office of Science and Technology,
Health Ecological Criteria Division
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Tt
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I.   Goal:

The outcome of this analysis will include a very brief report and the following:

- A GIS map of relevant locations with applicable data throughout the western ecoregions.
- A database containing relevant data that is gleaned from reported studies/assessments.
- A conceptual model for stressor-response relationships for the stream types (subclasses) that WDOE identifies.
- Site classes and co-varying environmental variables used to reduce natural variability in the nutrient data developed from the broader (multi-state) dataset.
- Analysis of the above biological samples (periphyton identification and quantification), funds permitting.

Nutrient endpoints from stressor response analysis (or other methodology, see caveat, below) including visual plots of interest, linear and nonlinear models, tables of conditional probability estimates, and thresholds determined using visual estimates with nonlinear and/or non-parametric models.   In the latter case (including change-point analysis), the proportion error reduction will be reported.

II.   Contact Information

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III.   Background:

WA Department of Ecology (WDOE) approached EPA NSTEPS for support with answering questions related to their nutrient criteria program. Some of the questions that WDOE would like to answer are relevant to the existing narrative nutrient criteria in the state standards. These questions include:

Can nuisance aquatic growths be defined quantitatively?
Are nutrients associated with these growths in a stressor-response context?
Can nutrient overabundance benchmarks be established to protect against unwanted nuisance aquatic growths?
Can stressor-biological response models be used to help inform assessments of water bodies for violations of numeric criteria for dissolved oxygen and pH?

Available WDOE data include a variety of parameters, from nutrients (N, P) to pH, DO, chlorophyll a, algal biomass and periphyton community composition. The existing dataset (over 300 sites sampled using WDOE protocols) covers a range of field seasons from 2010-present and includes both reference sites and eutrophic sites. In total, when including national datasets (i.e., USGS NAWQA and EPA NRSA) data from over 450 sites are included in the WA dataset.

While data have been collected throughout the state, most of the data collected by WDOE have been from minimally impacted sites (i.e., reference sites), which may limit the gradient of human stressors represented by much of this data. However, due to the 2015 RSMP Stormwater Monitoring effort in the Puget Sound, which employed WDOE protocols, data are now available from sites likely representing a wider gradient of human influence, including nutrients. Furthermore, a fair number of sites have been sampled by NAWQA in the Columbia Plateau, likely representing a gradient of agricultural stressors, including nutrients. Therefore, specifically in the Puget Sound and Columbia Plateau, the data likely represent two of the most prevalent human stressors influencing streams and rivers, urbanization and agriculture.

WDOE is seeking NSTEPS support to further identify analyses and sites critical for the development of stressor-response relationships, if needed based upon the data in hand.

Proposed Project timeframe:

  From workplan approval until approximately August 30, 2017.

  The dates provided below for specific tasks are contingent on project team availability and feedback and are to be viewed as a proposal rather than as absolute

Task 1: Administration and Communication

Tetra Tech (Tt) will provide regular reports on progress and financial tracking of this project. In addition, Tt will participate in regular conference calls and webinars to communicate progress and solicit and incorporate feedback from participants

Deliverables: Calls and progress reporting
Schedule: Ongoing

Task 2: Conceptual Model Development

WDOE will develop a conceptual model linking the nutrient stressors and other intermediate stressors (for which nutrient criteria will be explored) to the state's narrative nutrient and algal growth criteria and designated uses. The purpose of this task is to establish clear linkages between the stressors and the achievement of the WDOE's management goals with respect to designated use attainment. WDOE may rely on technical support from EPA and/or Tetra Tech in developing this conceptual model.

Activities:
- Conference call to discuss sources of information for developing the conceptual model, as well as potential assessment endpoints, measures of effect, and measures of exposure that could be captured in the conceptual model (all of which could be linked scientifically to WA's designated uses)
- WDOE drafts conceptual model
- Conference call to provide feedback on the conceptual model
- WDOE completes conceptual model

Anticipated outcome/deliverable: An annotated conceptual model describing sources, intermediate stressors, immediate stressors, modifying factors, nutrients, and effects on designated uses.

NSTEPS Deliverable: Conceptual Model Support and Review as directed
Schedule: March 30, 2017

Task 3: Data acquisition, data merge, and database development

Tt will identify sites (including data from sites neighboring Washington) with relevant data for developing a stressor-response relationship across the state. The data will be gleaned from consistent national studies, as well as any individual studies conducted in WA or neighboring states. Tt anticipates merging the WA dataset with that compiled for OR. Tt will compile the data in a relational database that will allow manipulation of data subsets for subsequent tasks. Tt shall

plot and develop GIS shapefiles of stream sampling sites in WA and other western states and provide additional geographic layers as context (e.g., watershed boundaries, stream networks, state and county boundaries, elevation, etc.).

Activities:
- Conference call to discuss what constitutes "relevant data" (i.e., water chemistry, biological data, physical and hydrologic data, etc.) and potential data sources
- Examination of data sources for relevant data
- Documentation and mapping of data sources that contain relevant data
- Data will be acquired, compiled, and organized into an existing database managed by WDOE or into a new database (format TBD)
- Taxonomic reconciliation for algae completed to result in one operational taxonomic system for use in calculating algal metrics;
- Calculation of algal metrics;
- Data will be initially QC'd and flagged for potential issues (e.g., outliers, censored data, etc.)
- Data will be characterized in terms of temporal and spatial dimensions

Anticipated outcome/deliverable: Dataset of geo-referenced, relevant water quality data; GIS shapefiles and maps depicting the distribution of sites; Data summaries characterizing the temporal and spatial extent of the data; Report documenting the work completed under Task 2.

Deliverables: Draft Water Quality Dataset and Geodatabase
Schedule: April 7, 2017 (first draft); April 28, 2017 (final draft)

Task 4: Exploratory and initial data analysis

Nutrient endpoints (primarily TN and TP) will be compared to response variables such as pH, DO, algal biomass, chlorophyll a, and especially periphyton community metrics. The comparison will include visual plots of interest, linear and nonlinear curve fits, conditional probability estimates for established response thresholds, and thresholds determined using visual estimates with nonlinear and/or nonparametric models. In the latter case, error associated with the threshold will be reported.

Deliverable: Analysis report
Schedule: June 23, 2017 (first draft); August 30, 2017 (final draft)